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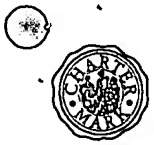

The Patent Office
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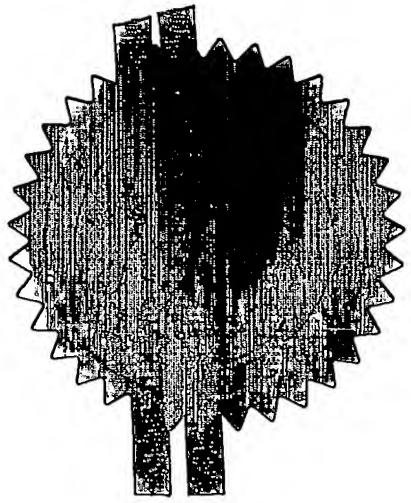

Signed A M Brewer

Dated 1 December 2004

Patents Form 1/77

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Request for grant of a patent

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1. Your reference

RFW/ND/CB60637P

2. Patent application number
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0329678.7

22 DEC 2003

3. Full name, address and postcode of the or of each applicant *(underline all surnames)*

GlaxoSmithKline Consumer Healthcare GmbH & Co. KG.
Bussmatten 1,
D - 77815 Buehl (Baden)
Germany

Patents ADP number *(if you know it)*

8304701001

German

If the applicant is a corporate body, give the country/state of its incorporation

4. Title of the invention

Toothbrush

5. Name of your agent *(if you have one)*

Corporate Intellectual Property

"Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*

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CORPORATE INTELLECTUAL PROPERTY (CN9 25.1)
980 GREAT WEST ROAD
BRENTFORD
MIDDLESEX
TW8 9GS

Patents ADP number *(if you know it)*

8072555006

6. Priority: Complete this section if you are declaring priority from one or more earlier patent applications, filed in the last 12 months.

Country	Priority application number *(if you know it)*	Date of filing *(day / month / year)*

7. Divisionals, etc: Complete this section only if this application is a divisional application or resulted from an entitlement dispute (see note f)

Number of earlier UK application	Date of filing *(day / month / year)*

8. Is a Patents Form 7/77 (Statement of inventorship and of right to grant of a patent) required in support of this request?

Answer YES if:

a) any applicant named in part 3 is not an inventor, or
b) there is an inventor who is not named as an applicant, or
c) any named applicant is a corporate body.

Otherwise answer NO (See note d)

Patents Form 1/77

9. Accompanying documents: A patent application must include a description of the invention. Not counting duplicates, please enter the number of pages of each item accompanying this form:

Continuation sheets of this form	
Description	10
Claim(s)	3
Abstract	
Drawing(s)	3

10. If you are also filing any of the following, state how many against each item.

Priority documents	
Translations of priority documents	
Statement of inventorship and right to grant of a patent (Patents Form 7/77)	
Request for a preliminary examination and search (Patents Form 9/77)	1
Request for a substantive examination (Patents Form 10/77)	
Any other documents (please specify)	

11. I/We request the grant of a patent on the basis of this application.

Signature(s) R. F. Walker Date 22 December 2003

12. Name, daytime telephone number and e-mail address, if any, of person to contact in the United Kingdom

R. F. Walker
ralph.f.walker@gsk.com
020 8047 4485

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Notes

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b) Write your answers in capital letters using black ink or you may type them.

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f) Part 7 should only be completed when a divisional application is being made under section 15(4), or when an application is being made under section 8(3), 12(6) or 37(4) following an entitlement dispute. By completing part 7 you are requesting that this application takes the same filing date as an earlier UK application. If you want the new application to have the same priority date(s) as the earlier UK application, you should also complete part 6 with the priority details.

Toothbrush

This invention relates to toothbrushes, in particular to electrically powered toothbrushes.

Electrically powered toothbrushes generally comprise a handle which contains inter alia a power supply and a drive motor, and a head part connected to the handle and which incorporates a brush head which supports one or more oral hygiene part to be driven by the motor. Often the head part comprises a neck part between the brush head and the handle. Generally the handle also includes a transmission means such as a gear system with a drive shaft between the oral hygiene part and the motor by means of which rotary motion from the motor is transmitted to the brush head to thereby move the oral hygiene part in a suitable oral hygiene motion.

Numerous types of oral hygiene motion are known. For example the brush head may be moved in rotary motion about a rotation axis transverse to the handle-head part, which may be oscillatory rotary, i.e. motion involving reciprocal angular displacement about a mean position. Suitable means for achieving such oscillatory motion are well known in commercially available electric toothbrushes. Sometimes the rotary motion also involves a reciprocal back and forth movement of the oral hygiene part along the rotational axis direction. Another known type of oral hygiene motion is a so called "Bass" motion, i.e. motion according to the known Bass technique, in which the oral hygiene part is moved both reciprocally longitudinally and also in oscillatory rotation about a rotation axis generally parallel to the longitudinal direction. Motion of this latter type is for example disclosed in EP-A-0 628 291 (Philips Electronics), WO 93/09729 (Bausch & Lomb Inc), and US-A-3,577,579 which also disclose suitable transmission means to convert rotary motion from the motor into such oral hygiene motion.

Often the head part or brush head is replaceable. For example the brush head may be replaceably connectable to the end of the head part remote from the handle. Alternatively the brush head may be integral with the neck, and the neck may be replaceably connectable to the handle at the end of the head part remote from the brush head.

The term "oral hygiene part" as used herein refers to a part which contributes to oral hygiene, for example by cleaning the teeth, gums or other oral

tissues, and/or polishing or whitening the teeth, and/or massaging the gums or other oral tissues. Numerous types of oral hygiene part are known. Bristles, generally arranged in tufts, are the most common type of oral hygiene part but other types are known.

A problem with all toothbrushes, including electrically powered toothbrushes, is that of alleviating excessive pressure of the oral hygiene part against the teeth or other oral tissues. Another problem is that of enabling the brush head to adapt its position to the shape of the teeth so as to reach all tooth surfaces for cleaning. A solution to these problems in electric powered tothbrushes is offered by flexible linking between for example the brush head and neck as in EP-A-1 182 254 (Trisa) in which the brush head is connected to the neck part by a resiliently flexible link. An alternative solution is for example provided by WO-A-94/05299 and US-A-5,406,664 in which the neck is flexibly linked to the handle. Both of these solutions require a complex transmission means between the motor and the oral hygiene part, e.g. a flexible link in the transmission means, because the transmission means needs to be flexible in a direction transverse to the longitudinal axis. It is an object of this invention to provide an improved electrically powered toothbrush with flexible linking between the brush head and handle with a simplified transmission means.

According to this invention an electrically powered toothbrush is provided comprising:

a handle which contains an electric motor and an electrical power supply,

a head part connected to the handle and incorporating an oral hygiene part to be driven in motion by the electric motor,

a transmission means between the motor and the oral hygiene part

the head part being flexibly and resiliently connected to the handle such that the head part can move resiliently under pressure of the oral hygiene part against a tooth surface,

characterised in that;

the motor is moveably mounted within the handle,

and the head part and motor are connected together such that said movement of the head part under the pressure of the oral hygiene part against a tooth surface is

communicated to the motor to cause the motor to move in response to said movement.

By the construction provided by the invention a simpler transmission means can be achieved because under pressure of the oral hygiene part against a tooth surface the motor and the head part move together, so they do not need to be connected by a transmission means that is flexible to accommodate relative motion of the head part and the motor. That is, the position and connection of the motor and head part relative to each other may be rigid.

The handle may typically comprise a plastics material shell bounded by a wall enclosing its internal components e.g. the motor and batteries, as common in the art. Typically the handle is elongate to facilitate grip by the user, having an end closest to the head part and an opposite end remote from the head part.

The transmission means may also be moveably mounted within the handle so that the movement of the head part under the pressure of the oral hygiene part against a tooth surface is communicated to the transmission means to move in response to said movement. For example the motor and transmission means may be rigidly connected so that they move in this way together. That is, the position of the motor and transmission means relative to each other may be rigid.

The transmission means typically comprises a gear system and a drive shaft between the motor and the oral hygiene part to convert the output motion of the motor, typically rotary motion, to motion of the oral hygiene part.

The gear system may be generally conventional, comprising for example a reduction gear system to reduce or increase the speed of rotation transmitted from the motor to the shaft, and/or means to convert rotary motion to another mode of motion of the drive shaft. The gear system may for example include conventional gearbox components such as intermeshing gear wheels etc.

The transmission means may for example communicate rotary motion to the brush head to drive the brush head in rotary oral hygiene motion.

Preferably the transmission means communicates motion to the brush head to drive the brush head in the so called "Bass" motion in which the oral hygiene part is moved both reciprocally longitudinally in the head part – handle direction, i.e. in the elongate direction of the drive shaft, and also in oscillatory rotation about a rotation

axis generally parallel to the longitudinal direction, i.e. the longitudinal axis of the drive shaft. Such a gear system is for example disclosed in above-mentioned EP-A-0 628 291 and US-A-3577,579.

The gear system of such a transmission means may be located within the handle. Normally the gear system will be enclosed within a gear housing.

The drive shaft may be generally conventional, comprising for example a metal or rigid plastics material shaft connected to an output shaft of the gear system and being connected or connectable to the oral hygiene part.

Preferably the assembly of motor and transmission means is pivotally connected to the handle at a pivot point between the brush head and the motor, preferably between the gear system and the brush head. The assembly of motor, transmission means and head part can move pivotally about such a pivot point in response to movement of the head part under the pressure of the oral hygiene part against a tooth surface. Such a pivot point may be at a point on the drive shaft intermediate between the gear system and the brush head.

Such a pivot point may allow the head part to move pivotally within the envelope of a cone with its apex at the pivot point, or about an arc centred on the pivot point.

In a preferred construction, such a pivotal connection may be achieved by providing a sleeve between the gear system, e.g. the gear housing, and the head part, having a bore through which the drive shaft passes in the handle-head part direction, and by resiliently flexibly connecting the sleeve to the handle between the gear system and the head part.

When the head part is replaceably connectable to the handle the drive shaft may pass through the wall, e.g. via such a sleeve, so that an end of the drive shaft projects outside of the wall of the handle, and this end may be connectable to the head part so as to thereby communicate motion to the head part. For example if the brush head is to move with the abovementioned Bass motion the entire head part may be moved when the head part is connected to the handle. Alternatively if the brush head is to be moved with rotary motion the head part may include a drive shaft which connects to this end when the head part is connected to the handle and

communicates rotary motion to the brush head. The sleeve may carry the shaft through the wall of the handle via a bush bearing.

Such a sleeve may be flexibly resiliently connected to the handle, e.g. at such a bush bearing, in various ways.

In one way a part of the wall of the handle may be made resiliently flexible, e.g. a wall part made of one or more plastics material structural member and one or more elastomeric material structural member, so that the shaft passes via the sleeve through this resiliently flexible part of the wall. For example such a flexibly resilient part of the wall may comprise the end of the handle closest to the head part.

In another way the sleeve may pass through a first rigid part of the wall of the handle, and this first rigid part may be flexibly and resiliently connected to a second part of the wall by a resiliently flexible connection part, for example comprising a composite region of one or more plastics material structural member and one or more elastomeric material structural member. For example such a first rigid part may comprise the end of the handle closest to the head part.

The motor or the assembly of motor and transmission means may be unsupported within the handle except at such a pivot point, so that the motor or assembly is free to move within the handle as the motor or assembly and the head part pivot.

Alternatively the handle and motor or assembly may be provided with guide features to allow the motor or assembly to move within the handle only in preferred directions, and/or may be provided with abutment features to allow the motor or assembly to move within the handle only within defined limits, for example in an arc. Normally the oral hygiene part has a surface on which are mounted oral hygiene elements such as bristles and such an arc is preferably in a plane perpendicular to this surface.

The invention also provides a handle for an electrically powered toothbrush which contains an electric motor and an electrical power supply, the handle being flexibly and resiliently connectable to a head part which incorporates an oral hygiene part to be driven in motion by the electric motor, such that when connected

the head part can move resiliently under pressure of the oral hygiene part against a tooth surface,

characterised in that;

the motor is moveably mounted within the handle and the head part and motor are connectable together such that said movement of the head part under the pressure of the oral hygiene part against a tooth surface is communicated to the motor to cause the motor to move in response to said movement.

The handle and head part may be otherwise generally conventional, for example made of the plastics materials, or plastics materials and elastomeric materials, metals etc. of which electrically powered toothbrushes are normally made. The motor and transmission means may also be generally conventional. Typically electric motors commonly used in electric toothbrushes are rotary motors with an 0.3W drive shaft power rating, with an estimated efficiency of 50%. The electric power supply and associated switching means may also be conventional, for example one or more replaceable and/or rechargeable battery cell. The electrical connections between the motor and electrical power supply and the switching means should be adaptable to the above-described movement of the motor, e.g. they may comprise flexible connectors such as wires.

The oral hygiene part of the brush head may for example comprise generally conventional bristles, cleaning/polishing pads, elastomeric lamellae etc.

The invention will now be described by way of non-limiting example only, with reference to the accompanying drawings which show:

Fig. 1 shows a schematic overall longitudinal sectional view of an electric toothbrush of this invention.

Fig. 2 shows a more detailed longitudinal sectional view of another electric toothbrush of this invention.

Fig. 3 shows a schematic overall longitudinal sectional view of another electric toothbrush of this invention.

Parts shown in Figs. 1, 2 and 3 are listed below:

10 electric toothbrush overall in side view

20 hollow grip handle

21 wall of handle

22 batteries

23 motor

24 motor output shaft

25 gear system

26 sleeve

27 drive shaft

28 bush bearing

29 connection spigot

210 rigid part of wall

211 resiliently flexible connection

212 plastics material structural members

213 elastomeric material structural members

214 apertures

215 on-off switch

216,217 flexible connections

30 head part

31 neck

32 brush head

33 support for bristles

34 bristles

35 connection socket

36 bore of neck

37 drive shaft

38 bayonet connection

41 flexible membrane

Referring to Fig. 1 an electric toothbrush is shown overall 10 in side view. The toothbrush 10 comprises an elongate hollow grip handle 20 bounded by a wall 21 (part shown) of plastics material, at one end of the handle being connected a head part 30. The head part 30 comprises a neck 31 and a brush head 32. The brush head 32 comprises a support 33 in which bristles 34 are mounted and project in a bristle direction B. The bristle configuration shown is purely representative. The

handle 20 and head part 30 lie along a handle-head part direction (A–A) shown to be a straight line but which may enclose a non 180° angle or curve.

The handle 20 encloses a power supply comprising plural (two are shown, there may be more or less) conventional AA replaceable or rechargeable batteries 22, conventionally enclosed and conventionally supported in handle 20. If the batteries 22 are replaceable then handle 20 may be openable in a conventional manner, e.g. by the end of the handle 20 furthest from the head part 10 being removeable to facilitate replacement.

Handle 20 also contains a conventional drive motor 23 typical of those used in conventional electric toothbrushes. Motor 23 drives its output shaft 24 in rotary motion about a rotation axis generally parallel to direction A-A at ca. 5000 rpm. Output shaft 24 is connected to gear system 25 enclosed in a gear casing, and converts the rotary motion of output shaft 24 into motion of a known type in which the output drive shaft 26 of gear system 25 moves longitudinally reciprocally in the direction A-A with a displacement ca. 1 mm and simultaneously in reciprocal oscillatory rotary motion about a rotation axis generally parallel to direction A-A with an amplitude ca 5-7°.

A sleeve 27 extends between gear system 25 and the end of the handle 20 closest to the head part 10 and drive shaft 26 passes along the bore of sleeve 27 in the direction A-A. Sleeve 27 is connected to the wall 21 at this end, by for example integral manufacture of the wall 21 and sleeve 27, or by means of a suitable bush bearing 28 rigidly mounted in a known manner in wall 21. Shaft 26 and passes through the wall 21 of handle 20 via this connection. The part of drive shaft 26 outside of handle 20 is formed into spigot 29.

Spigot 29 is connectable e.g. by a known bayonet connection into a socket 35 in the end of head part 30 closest to handle 20. So that the head part 30 is moved with the longitudinally reciprocally and reciprocal oscillatory rotary motion of shaft 26. Shaft 26 and sleeve 27 may be made of low friction materials. For example shaft 26 may be smooth metal and sleeve 27 of smooth plastic, or plastic with a low friction sleeve lining.

Motor 23, the casing of gear system 25 and sleeve 27 are rigidly connected together so that components 23, 25 and 27 are rigid against relative motion.

Sleeve 27 passes via bush 28 through a rigid part 210 of the wall 21 of the handle 20. This rigid part 210 is flexibly and resiliently connected to a second part of the wall comprising the remainder of handle 20 by a resiliently flexible connection part 211. This part 211 comprises a composite region of plastics material structural members 212 and elastomeric material structural members 213 (only one shown). These elastomeric structural members 213 are provided by apertures 214 in the wall 21, which are closed by the elastomeric material 213.

Such a structure can be produced using well known two-component injection moulding techniques as used currently in making electric toothbrush handles.

In use the motor 23 is actuated by operating the on-off switch 215 to connect motor 23 to batteries 22 via connectors 216,217 which are flexible, e.g. wires. This causes motor 23 to drive head part 30 via gear system 25 and shaft 26. There is a small gap between the longitudinally opposed facing surfaces of bush 28 and neck 31 to allow the longitudinal reciprocal motion of the head part.

When brush head 32 is pressed against the user's teeth (not shown) this causes the assembly of head part 30, sleeve 27, gear system 25 and motor 23 to pivot resiliently about bush 28 as the flexible region 211 resiliently deforms in response to this pressure, so that motor 23 moves within handle 20 in the arc shown and thereby reduce excessive brushing pressures on the teeth.

Referring to Fig. 2 a more detailed cross section of an electric toothbrush according to the invention is shown, with parts corresponding to Fig. 1 numbered correspondingly (connection 217 is hidden). In the toothbrush of Fig. 2 the on-off switch is enclosed within a flexible membrane 41 of the elastomeric material. The arrangement of bristles 34 is purely representative.

Fig 3 shows an alternative construction of toothbrush 10 in which head part 32 incorporates a rotatable support 33 for the bristles 34, mounted to rotate about a rotation axis perpendicular to A-A. Neck part 31 is a hollow shaft having an internal bore 36 along which passes a drive shaft 37, which is configured to drive support 33 in oscillatory rotary motion in a known manner. Neck part 31 replaceably connects to bush 28 at known bayonet connection 38, such that shafts 26 and 37 connect in a known way so that rotary motion of shaft 26 is communicated to shaft 37. In the construction of Fig. 3 the gear system 25 is such

as to communicate rotary motion to shaft 26, and may include a gear so that shaft 26 rotates at a different speed than shaft 24. The movement of the motor 23 in the arc shown is analogous to that of Figs. 1 and 2.

Claims

1. An electrically powered toothbrush comprising

a handle which contains an electric motor and an electrical power supply,

a head part connected to the handle and incorporating an oral hygiene part to be driven in motion by the electric motor,

a transmission means between the motor and the oral hygiene part

the head part being flexibly and resiliently connected to the handle such that the head part can move resiliently under pressure of the oral hygiene part against a tooth surface,

characterised in that;

the motor is moveably mounted within the handle,

and the head part and motor are connected together such that said movement of the head part under the pressure of the oral hygiene part against a tooth surface is communicated to the motor to cause the motor to move in response to said movement.

2. A toothbrush according to claim 1 *characterised* in that the transmission means is also moveably mounted within the handle so that the movement of the head part under the pressure of the oral hygiene part against a tooth surface is communicated to the transmission means to move in response to said movement.

3. A toothbrush according to claim 1 or 2 *characterised* in that the transmission means communicates rotary motion to the brush head to drive the brush head in rotary oral hygiene motion.

4. A toothbrush according to claim 1 or 2 *characterised* in that the transmission means communicates motion to the brush head to drive the brush head both reciprocally longitudinally, and also in oscillatory rotation about a rotation axis generally parallel to the longitudinal direction.

5. A toothbrush according to any one of the preceding claims *characterised* in that the assembly of motor and transmission means is pivotally connected to the handle at a pivot point between the brush head and the motor.

6. A toothbrush according to claim 5 *characterised* in that the pivot point allows the head part to move pivotally within the envelope of a cone with its apex at the pivot point, or about an arc centred on the pivot point.

7. A toothbrush according to claim 5 or 6 *characterised* in that the transmission means comprises a gear system and a drive shaft between the gear system and the brush head and the pivot point is at a point on the drive shaft intermediate between the gear system and the brush head.

8. A toothbrush according to claim 7 *characterised* in that a pivotal connection is achieved by providing a sleeve between the gear system and the head part, having a bore through which the drive shaft passes in the handle-head part direction, and by resiliently flexibly connecting the sleeve to the handle.

9. A toothbrush according to claim 8 *characterised* in that the head part is replaceably connectable to the handle and the drive shaft passes through the wall so that an end of the drive shaft projects outside of the wall of the handle, and this end is connectable to the head part so as to thereby communicate motion to the head part.

10. A toothbrush according to claim 8 or 9 *characterised* in that the sleeve is flexibly resiliently connected to the handle by making a part of the wall of the handle resiliently flexible so that the shaft passes via the sleeve through this resiliently flexible part of the wall.

11. A toothbrush according to claim 7 or 8 *characterised* in that the shaft passes through a first rigid part of the wall of the handle, and this first rigid part is flexibly

and resiliently connected to a second part of the wall by a resiliently flexible connection part.

12. A toothbrush according to any one of the preceding claims *characterised* in that the assembly of motor and transmission means is unsupported within the handle except at such a pivot point.

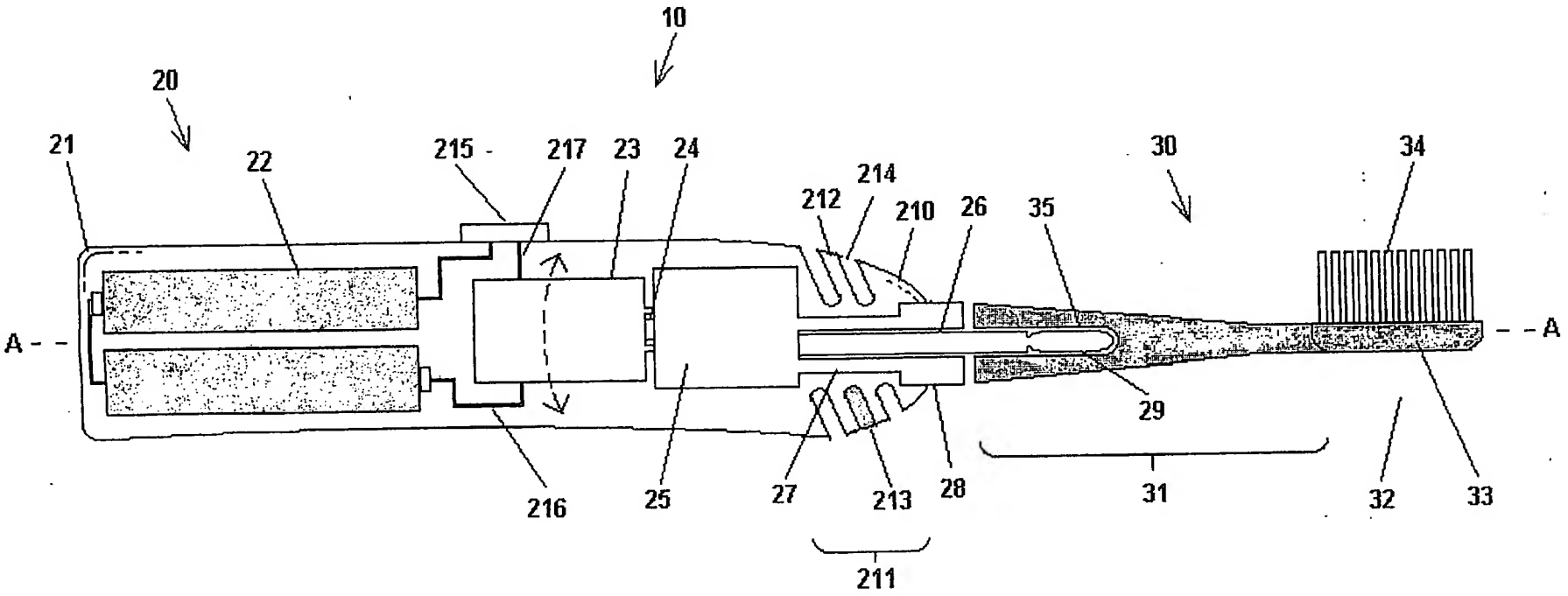
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FIG. 1

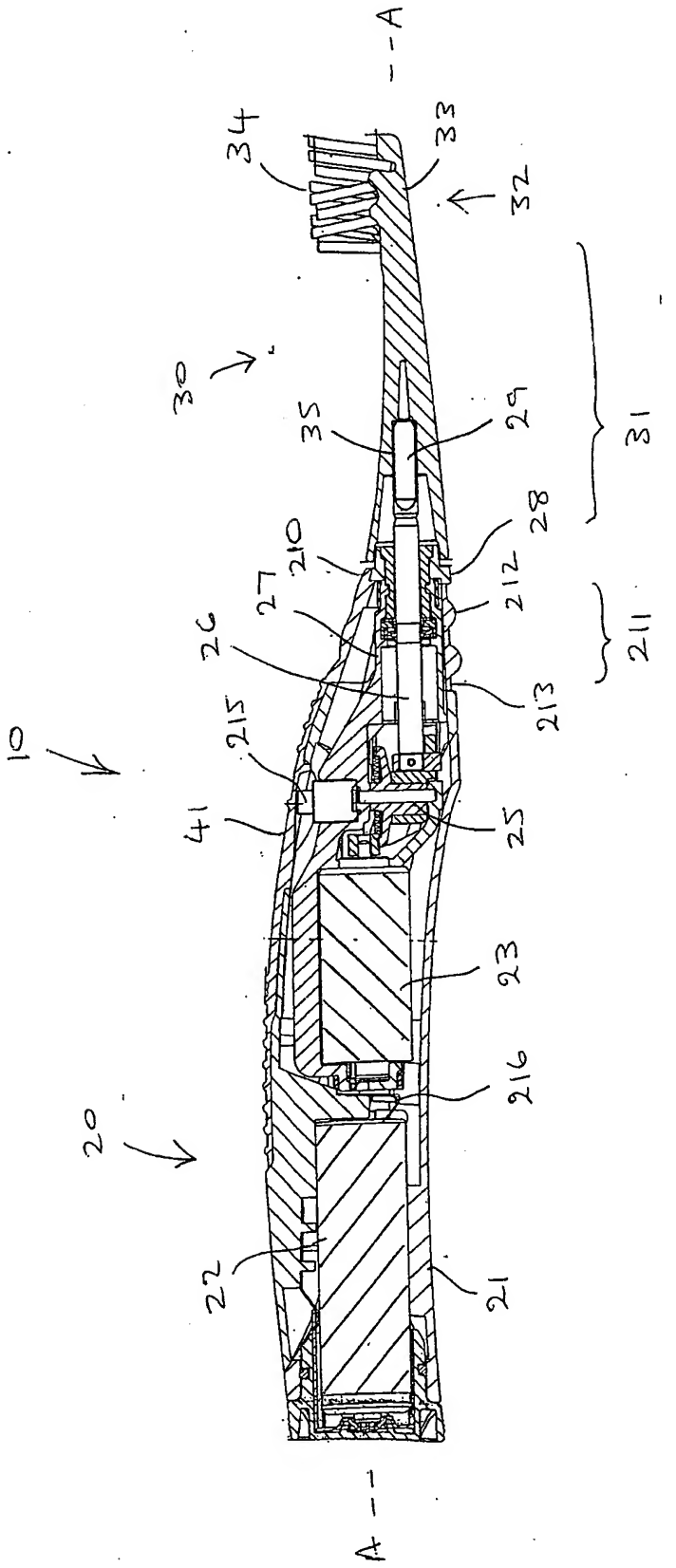
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Fig. 2

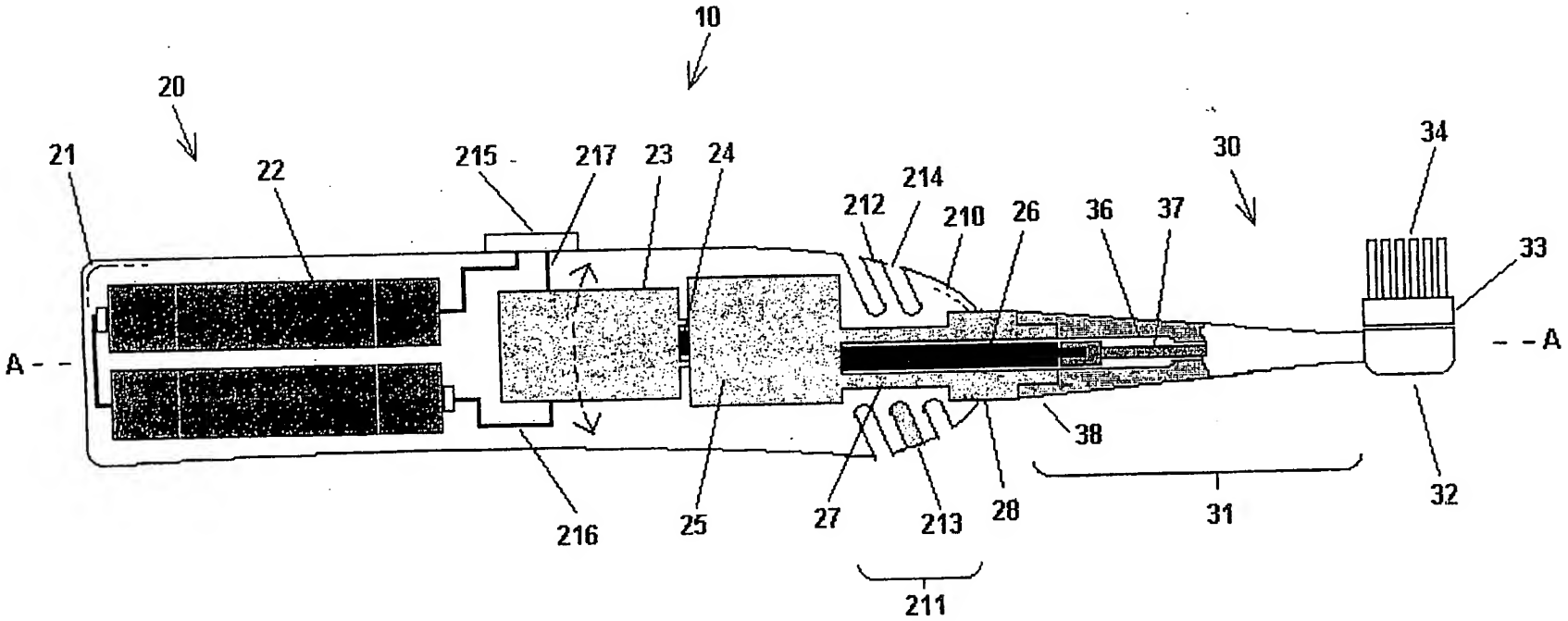
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FIG. 3